Proceedings of the 8th World Congress on Civil, Structural, and Environmental Engineering (CSEE'23)
Lisbon, Portugal – March 29 – 31, 2023
Paper No. ICGRE 112
DOI: 10.11159/icgre23.112

A 2D Nonlinear Soil Response Based On the Influence of Vertical Component in Near-Fault Conditions

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Extended Abstract

Seismic site response analysis is usually characterized by assuming that vertical acceleration of an earthquake varies between ½ and 2/3 of the horizontal acceleration. Recently, studies have found that this relation can change significantly depending on the period and distance to the fault [1] [2]. The ratio of vertical to horizontal acceleration (V/H) can exceed 1.0 for short period and near fault conditions and the commonly adopted ratios of ½ and 2/3 is related to far fault condition. In this paper, we propose a numerical simulation based on a parametric two-dimensional soil response analysis, in order to analyze the influence of vertical acceleration in near fault conditions. Material and geometric parameters related to the Young modulus, damping ratio and soil column thickness will be considered within a parametric approach which can allows us to evaluate for various subsoil conditions. The parametric solution is based on the Proper Generalized Decomposition (PGD) [3] framework that allows efficient multidimensional solutions of transient dynamics operating in the frequency-domain. Soil nonlinearity will be considered in a real time manner from the offline construction of the parametric solution, where shear modulus and damping factor of soils are modeled as equivalent linear relations of the shear strain [4]. The algorithm proposes an online integration that proceeds by particularizing the parametric solution for the Young modulus and damping parameters, and then update it, from the just calculated solution, regard the level of deformation [5]. The iteration process continues until reaching convergence. The aim is to be able to compute very fast solutions to non-linear soil dynamics and to examine the dynamic response of different stratified surface configurations considering the nonlinear characteristics, in order to evaluate the role of the vertical component of the seismic movement.

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